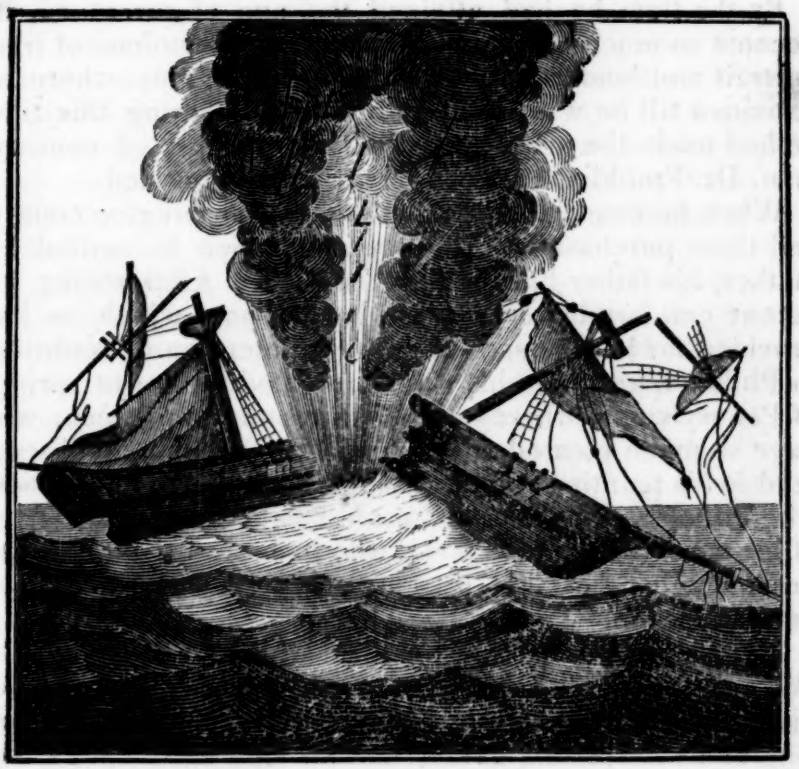
The Mechanic.

APRIL, 1834.

[Compiled for the Mechanic.]

ROBERT FULTON.



[The blowing up of the Danish Brig, furnished for the experiment by the British Government, with one of Fulton's torpedoes.—Page 116.]

THIS indefatigable man, and benefactor of the human race, was born in Little Britain, Lancaster County, Pennsylvania, in the year 1765, of a respectable, though not opulent family. His father was a native of Kilkenny in Ireland, and his mother was of a respectable Irish family,

residing in Pennsylvania. He had two sisters older than himself, besides a younger brother and sister. His patrimony was very small: this he did not conceal, but was fond of making it known; for he wished to be considered, as he really was, the maker of his own fortune.

In his infancy he received the rudiments of a common English education, and his peculiar genius manifested itself at a very early age. In his childhood, all his hours of recreation were passed in the shops of mechanics, or in the use of his pencil; and at this early period of life, he had no other desire for money than to supply himself with the necessary materials to indulge his taste for mechanism and drawing.

By the time he had attained the age of seventeen, he became so much of an artist, as to derive emolument from portrait and landscape painting in Philadelphia, where he remained till he was about twenty-one. During this time he had made the acquaintance of our celebrated countryman, Dr. Franklin, by whom he was much noticed.

When he came of age, he went to Washington county, and there purchased a little farm, on which he settled his mother, his father having died in 1768. After seeing his parent comfortably established in the home which he had provided for her, he set out with the intention of returning to Philadelphia. On his way, he visited the warm springs of Pennsylvania, where he met with some gentlemen, who were so much pleased with the genius which they discovered in his paintings that they advised him to go to England, where they assured him he would meet with the patronage of his countryman, Mr. West, who had, even then, attained great celebrity in that art, in which he has since been unrivalled.

Mr. Fulton went to England, and his reception by Mr. West was such as he had been led to anticipate. That distinguished American was so well pleased with his promising and enterprising genius, and his amiable qualities, that he took him into his house, of which he continued an inmate for several years. After leaving the family of Mr. West, he appears to have made the art of painting his chief employment for some time. He spent two years in Devonshire, near Exeter, where he made many respectable acquaintances; among others, he became known to the Duke of Bridgewater, so famous for his canals, and Lord

Stanhope, a nobleman celebrated for his love of science, and particularly for his attachment to the mechanic arts. With Lord Stanhope, Mr. Fulton held a correspondence for a long time, and they communicated to each other ideas on subjects towards which their minds were mutually directed.

In 1793, we find Mr. Fulton actively engaged in a project to improve inland navigation; for even at that early day, he had conceived the idea of propelling vessels by steam; and he speaks in his manuscripts with great confidence of its practicability. In May, 1774, he obtained from the British government, a patent for a double inclined plane, to be used for transportation. An account of this may be seen in Vol. 17 of the Repertory of Arts.

What were Mr. Fulton's pursuits for some years after this period it does not appear. In his preface to a description of his Nautilus, or Plunging-Boat, he says, that he had resided eighteen months in the great manufacturing town of Birmingham, where he must have acquired some of that practical knowledge in mechanics, which he made so useful to his country, and indeed to all the world. In 1804, when Mr. Fulton left Paris, he sent a large collection of his manuscripts to this country; but unfortunately, the vessel in which they were sent was wrecked. The case containing the papers was recovered, but only a few fragments of the manuscripts were preserved. These, however, mark the genius of a Fulton, and increase our regret that any productions of his strong and original mind which he thought worth preserving, should be lost. It is owing to this misfortune that we have so few traces of Mr. Fulton's occupations at this period. But a mind like his could never be idle, and it is evident that at this time, it was still directed towards his favorite pursuits.

In 1794, he submitted to the British Society for the Promotion of Arts and Commerce, an improvement of his invention. in mills for sawing marble, for which he received the thanks of the Society and an honorary medal. He invented also, as is presumed, about this time, a machine for spinning flax, and another for making ropes, for both of which he obtained patents from the British Government. A mechanical contrivance for scooping out earth in certain situations, to form the channels for canals or aqueducts, which, as it is understood, has been much used in England,

is also his invention. Indeed, the subject of canals appears chiefly to have engaged his attention at this time. He now, and probably for some time previous, professed himself a civil engineer, and under this title, he published his work on canals, and in 1795, some essays on the same subject in the London Morning Star. In 1796, he published in London, his Treatise on the Improvement of Canal Navigation, in which he recommends small canals and boats of little burden; and also inclined planes instead of locks, together with the various contrivances necessary to effect the passage of boats from one level to another. His plans were strongly recommended by the British Board of Agriculture, of which Sir John Sinclair was president.

Mr. Fulton, throughout his course as a mechanist and civil engineer, derived great advantages from his talent for drawing and painting. He was an elegant and accurate draughtsman, which is proved by the plates annexed to the work we have mentioned. This gave him great facility in procuring the execution of his designs, and a great advantage over most who have engaged in similar pursuits. He seems, however, to have neglected his pencil as a painter, for many years, till a short time before his death, when he resumed it to paint some portraits of his own family, and his success in executing these gave him much pleasure.

Mr. Fulton, ever thoughtful of the interests of his own country, sent copies of his works to distinguished persons in America, accompanied with letters, setting forth the advantages to be derived from internal communication by canals.

Having obtained a patent for canal improvements from the British government, he went to France, with the intension of introducing them there; but not meeting with much encouragement, he soon directed his mind to other important subjects; though the canal system still occupied a portion of his thoughts. About this time, his thoughts were turned towards the subject of political economy, and he wrote a work, addressed to 'The Friends of Mankind,' in which he labors to show, that *education* and *internal improvements*, would have a good effect on the happiness of a nation. He not only wished to see a free and speedy communication between the different parts of a large country, but a universal free trade between all nations. He saw that it would take ages to establish the freedom of the seas

by the common consent of nations; he therefore turned his whole attention to find out some means of destroying ships of war, those engines of oppression, and to put it out of the power of any nation to maintain such a system; and thus to compel every government to adopt the simple principles of education, industry, and a free circulation of its produce. Out of such enlarged and philanthropic views and reflections grew Mr. Fulton's inventions for sub-marine navigation and explosions, and with such patriotic motives did he prosecute them. Of these inventions we now proceed to give some account.

In the year 1797, he became acquainted with Mr. Joel Barlow, our celebrated countryman, then residing in Paris, in whose family he lived seven years, during which he learned the French, and something of the German and Italian languages. He also studied the high mathematics, physics, chemistry and perspective; thus storing up a fund of knowledge, which, when united with his uncommon natural genius, gave him such a great superiority over many of those, who, with some talents, but without any knowledge of science, have pretended to be his rivals. During his residence with Mr. Barlow, he projected the first panorama that was ever exhibited in France. This was a novelty which attracted many spectators and afforded a handsome emolument.

In December, 1797, he made an experiment in company with Mr. Barlow, on the Seine, with a machine which he had constructed, and by which he designed to impart to carcasses of gunpowder a progressive motion under water, and there to explode them; but he was disappointed in the performance of his machine. He continued, however, to make experiments with a view to the accomplishment of his object, until he had perfected the plan for his sub-marine boat.

A want of funds to enable him to carry his design into execution, induced him to apply to the French Directory. They at first gave him reason to expect their aid, but after a long attendance at the public offices, he received a note, informing him that they had totally rejected his plan. Mr. Fulton was not to be discouraged, but pursued his inventions; and having executed a handsome model of his machine, and a change in the directors having taken place, he presented his plan, and a commission was appointed to

examine his pretensions; but after three months attendance, he was again disappointed by finding his plan entirely rejected. Not yet, however, discouraged, he offered his project to the British government, through the ambassador from Holland; but without success, although a commission was appointed to examine his models. But the French government at length changed, and Bonaparte having placed himself at the head of it, Mr. Fulton presented an address to him, on which a commission was immediately appointed and assistance afforded, which enabled him to put some of his plans to practice. In the Spring of 1801, Mr. Fulton repaired to Brest, to make experiments with the plunging-boat which he had constructed the preceding winter. This, as he says, had many imperfections natural to a first machine, and had been injured by rust, as parts which should have been of copper or brass, were made of iron. Notwithstanding these disadvantages, he engaged in a course of experiments, which required no less courage than energy and perseverance. From a report of his proceedings to the committee appointed by the French executive, we learn, that on the third of July 1801, he embarked with three companions on board his plunging-boat in the harbor of Brest, and descended to the depth of five, ten, fifteen, and so on to twenty-five feet; but he did not attempt to go lower, because he found that his imperfect machine would not bear the pressure of the water at a greater depth. He remained below the surface an hour in utter darkness, which was very unpleasant, and candles were found to consume too much of the vital air; so he caused a small window of thick glass to be made near the bow of his boat, which afforded him light enough to count the minutes on his watch. Having satisfied himself that he could have sufficient light under water; that he could do a long time without fresh air, and descend to any depth or rise to the surface with facility; his next object was to try the movements of his vessel, as well on the surface as under it. He found that she would tack and steer, and sail on a wind or before it, as well as any common sailing boat. He then struck her masts and sails; to do which, and prepare for plunging, required about two minutes. Having plunged to a certain depth, he placed two men at the engine, which was intended to give her progressive motion, and one at the helm, while he, with a barometer before him, kept her

balanced between the upper and lower waters. He found that with one hand he could keep her at any depth he pleased; and that in about seven minutes he had gone about five hundred yards. He could turn her round while under water, and return to the place he started from. These experiments were repeated for several days, till he became familiar with the operation of the machinery and the motion of the boat. He found that she was as obedient to her helm under water as any boat could be on the surface; and that the magnetic needle traversed as well in one situation as in the other.

On the 7th of August, Mr. Fulton descended with a store of air compressed into a copper globe, whereby he was enabled to remain under water four hours and twenty minutes. The success of these experiments determined him to try the effects of these inventions on the English ships, which were daily near the harbor of Brest. Satisfied with his boat, he next made some experiments with the torpedoes, or sub-marine bombs. A small vessel was anchored in the roads, and with a bomb containing about twenty pounds of powder, he approached within about two hundred yards, struck the vessel and blew her into atoms. A column of water and fragments was blown near one hundred feet into the air. This experiment was made in the presence of the prefect of the department and a multitude of spectators.

Through the summer of 1801, and till the project was relinquished on account of the season, Mr. Fulton appears to have been watching the English ships which were on the coast; but though some of them daily approached off the harbor, yet none of them came so near, or anchored in such a situation, as to be exposed to the effects of his attempts. In one instance, he came very near a British seventy-four; but she, just in time, made such a change of position as to save herself. The rulers of France were discouraged by this want of success, or rather of opportunity, and so far from being willing to make farther advances for new experiments or efforts, they showed no disposition to fulfil the engagements they had already made to Mr. Fulton. The escape of the enemy's vessels seems to have lowered his invention so much in their estimation, that they refused to give him any further encouragement.

The English had some information respecting the attempts which their enemies were making, but did not know to what

extent they had been carried. Much anxiety was expressed, which induced the British minister to communicate with Mr. Fulton, the object of which was to deprive France of his services, and secure them to England. In this he was successful, and Mr. Fulton was induced to proceed to London, where he arrived in May, 1804. He soon had an interview with Mr. Pitt and Lord Melville. When Mr. Pitt first saw a drawing of a torpedo, with a sketch of the mode of applying it, and understood what would be the effect of the explosion, he said that if it were introduced into practice, it could not fail of annihilating all military marines; and when Mr. Fulton exhibited his torpedo and described its effects to the Earl St. Vincent, he exclaimed, in the strong language of his profession, against this mode of warfare, which, he said, with great reason, they who commanded the seas did not want, and which, if successful, would wrest the trident from those who claimed to bear it as the sceptre of supremacy over the ocean. From the subsequent conduct of the British ministry it may well be supposed, that they never truly intended to give Mr. Fulton a fair opportunity of trying the effects of his engines. The objects may have been to prevent them from being placed in the hands of an enemy; and if this was accomplished, it was the interest of England, as long as she was ambitious of the proud title of mistress of the seas, to make the world believe that Mr. Fulton's projects were chimerical. Nothing would be more likely to produce this effect than abortive attempts to apply them. Several expriments were made, and some of them were failures; but on the 15th of October, 1805, he blew up a strong built Danish brig of 200 tons burden, which had been provided for the experiment, and which was anchored in Walmar roads, near the residence of Mr. Pitt. The torpedo used on this occasion contained 170 pounds of powder, and in fifteen minutes from the time of starting the machinery, and throwing the torpedo into the water, the explosion took place. It lifted the brig almost entire, and broke her completely in two. The ends sunk immediately, and in one minute, nothing was to be seen of her but floating fragments. In fact, her annihilation was complete.

Notwithstanding the complete success of this experiment, the British ministry seem to have been but little disposed to have anything further to do with Mr. Fulton or his

projects. Indeed, the evidence it afforded of their efficacy may have been a reason for this conduct. After some further experiments, of which we have no particular account, he at length embarked for his native country, and arrived at New York the 13th of December, 1806.

Upon his arrival in this country, he immediately engaged in the projects, both of sub-marine war, and steam navigation. For the last he had made some preparations before he left England, but we intend to postpone this important subject, to be presented in one view, after tracing the progress of his other pursuits.

So far from being discouraged by his attempts at applying his torpedoes in Europe, his confidence was unabated, because he saw, as he said, that his failures were to be attributed to trivial errors, which actual experience only could discover, and which could be easily corrected. He very soon induced our government to afford him the means of trying further experiments, and invited the magistracy of New York and a number of citizens to Governor's Island, where were the torpedoes and machinery with which his experiments were to be made; and while he was explaining his blank torpedoes, which were large copper cylinders, his numerous auditors crowded around him. At length, he turned to a copper case of the same description, which was placed under the gate-way of the fort, and to which was attached a clock-work lock. This, by drawing out a peg, he set in motion, and then said to his audience: 'Gentlemen; this is a charged torpedo, with which, precisely in its present state, I mean to blow up a vessel. It contains 170 pounds of powder, and if I were to suffer the clock-work to run fifteen minutes, I have no doubt but that it would blow this fortification to atoms. The circle round Mr. Fulton was very soon much enlarged, and before five of the fifteen minutes were out, there were but two or three persons remaining under the gate-way. The apprehensions of the company amused him, and he took occasion to remark how true it was, that fear frequently arose from ignorance.

On the 20th of July, 1807, he blew up with a torpedo, in the harbor of New York, a large hulk brig, which had been prepared for the purpose. This experiment only served to prove to the inhabitants of New York, by ocular demonstration, that the explosion of a torpedo under a vessel's bottom would annihilate her.

The annexed cut represents one of Mr. Fulton's stationary torpedoes, which were to be carcasses of powder, having levers attached to the triggers of the locks; numbers of them were to be anchored in the channel through which vessels, to make an attack, must pass. The hostile vessel, in passing over a torpedo, would press the lever and cause an explosion. A is the lever, and B a portion of the rope to which the anchor is attached.

In a letter to the city government of New York Mr. Fulton says: 'You have now seen the effect of the explosion of powder under the bottom of a vessel, and this, I believe, is the best and most simple mode of using it, with the greatest effect in marine wars; for a right application of one torpedo will annihilate a ship, nor leave a man to relate the dreadful catastrophe. Thus, should a ship of the line, containing five hundred men, contend with ten good row boats, each with a torpedo and ten men, she would risk total annihilation, while the boats under cover of the night, and with quick movements, would risk only a few men out of a hundred. When two ships of equal force engage, it may be doubtful which will gain the victory; frequently one hundred men are killed, as many wounded, and the ships much injured. But even the vanquished vessels will admit of being repaired, and thus the number of ships of war will not be diminished; but will continue to increase and tyrannize over the rights of neutrals and peaceable nations.'

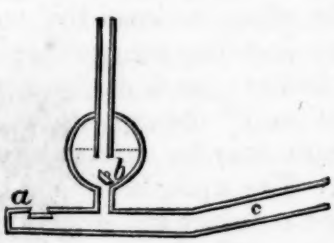
In March, 1810, five thousand dollars were granted by Congress for further experiments in sub-marine explosions, which gave Mr. Fulton another opportunity to exercise his skill. A commission was also appointed to be present and report the results. The sloop of war Argus was prepared for defence against the torpedoes, under the orders of Commodore Rogers, after Mr. Fulton had explained his mode of attack. The defence was so complete, that he found it impracticable to do anything with his torpedoes, as they were then prepared. Some experiments were tried, however, with his gun-harpoon and cable-cutter; and after several attempts, a fourteen inch cable was cut off, several

feet below the surface of the water. The gentlemen appointed to make the report did not exactly agree in sentiments, concerning these experiments. Mr. Fulton felt satisfied that he could so improve his apparatus, as to overcome all difficulties, and he pointed out many plans which were never executed; an account of which, though very interesting, we must omit for want of room. Mr. Fulton intended to have given a detailed account of these inventions, and of the embarassments under which he labored in bringing them so far towards perfection; and also to write his own life, and to leave memorials of many inventions which he had in his mind; but these designs were never executed.

His biography has been given by C. D. Colden, Esq., a friend of his, from such slight materials as have been casually preserved. There is no doubt but that many valuable ideas are lost. It is to be feared, that the hints which he has left for the improvement of his sub-marine warfare, which he thought so much of, will be neglected; partly for want of support, and partly for want of that rare combination of courage, industry, perseverance and skill, which Mr. Fulton possessed.

We shall conclude this sketch with an account of the Steam Boat in our next.

WATER RAM.

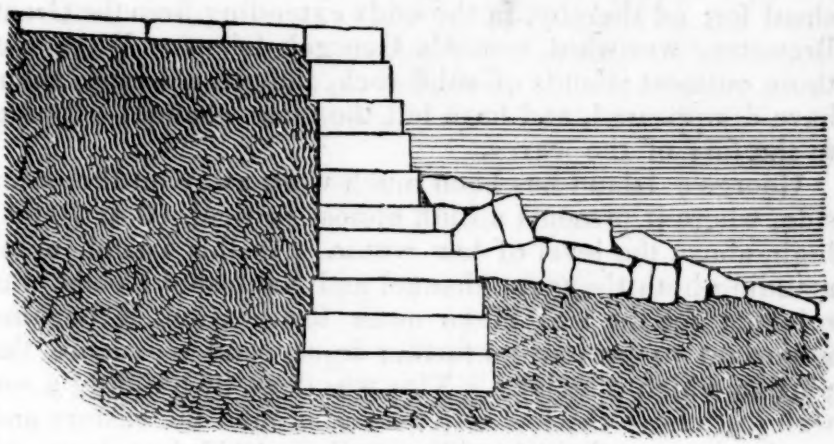


It had long been observed in household experience and elsewhere, that while water is running through a pipe, if a cock at the extremity be suddenly shut, a shock and noise are produced there. The reason is, that the forward motion of the whole water contained in the pipe being instantly

arrested, and the momentum of a liquid being as great as of a solid, the water strikes the cock with as much force as if it were a bar of metal or a rod of wood having the same weight and velocity. A leaden pipe, if of great length, is often widened or burst in this experiment. Lately this forward pressure of an arrested stream has been used as a force for raising water, and the arrangement of parts contrived to render it available has been called, on account of the shock, the *water ram.* The ram may be described as a sloping pipe in which the stream runs, having a valve at its lower end, to be shut at intervals, and a small tube rising from near the end towards a reservoir above, to receive a portion of the water at each interruption of the stream. Now in a pipe ten yards long, two inches wide, and sloping six feet, water allowed to run for one second acquires momentum enough to drive about half a pint, on the shutting of the cock, into a tube leading to a reservoir forty feet high. Such an apparatus, therefore, with the valve shutting every second, raises about sixty half-pints or four gallons in a minute. The valve is ingeniously contrived so that the stream works it as desired. In this figure, which represents the lower end of the water ram, *a* is the opening by which the stream escapes from it, and the valve or flap seen below the opening is that which by suddenly shutting arrests the stream. The valve is made so heavy, that the stream must run for a certain time to acquire force enough to shut it; and in the instant of its shutting, a little of the advancing water passes upwards through the valve *b* towards the reservoir. The water in the main pipe then becoming stagnant again, has no longer power, by its weight alone, to keep the valve *a* shut; this, therefore, falls open and the stream begins again; again to be arrested as before; and as long as the supply of water lasts, the action of the apparatus continues. The action of a water-ram may be compared to the beating of an animal's pulse. The upright tube is made wider at the bottom where it first receives the water, so as to constitute there an air vessel *b*, which, by the air's elasticity, converts the interrupted jets first received into a nearly uniform current towards the reservoir.—Arnott.

[For the Mechanic.]

SEA WALLS OF BOSTON HARBOR.



Section of Sea Wall on Deer Island.

MESSRS. EDITORS:—As a brief description of the constructions for the preservation of the outer islands of Boston Harbor may be interesting to some of your readers, it is here offered for insertion in the Mechanic.

As a preliminary remark, it is only necessary to allude to the force of the waves, when they come directly in contact with an opposing shore. Rolling or rather oscillating as they do, mountain high in the open sea, the upper portion gradually acquires a motion of translation, in the direction of the wind, while the depths below remain still. The top of the wave, moving the most rapidly, tends to form a vertical wall of water, till it breaks over with a crest of foam, and then subsides. On reaching the shoal water near the shore, this effect is increased. Each wave, now become a separate ridge of water, impelled by its acquired momentum, rolls up the shore 'like a thing of life,' and dashes itself with angry impetuosity against any obstacle which resists its progress, till it spends its force and subsides. If the obstacle before it be an earthen shore, each wave loosens a small stratum, which is carried away by the receding current or *undertow*, and deposited in some more still location. But as the breakers only act on that portion of the shore which is above a certain level, the lower portion being only affected by currents, the tendency is to

form extensive shoals, usually bare at low water, where once were lofty islands.

Such has been the action in Boston Harbor, during easterly storms. All the earth on the eastern side of the outmost islands has been washed away, and an extensive shoal formed thereby, in the eddy extending from the Great Brewster, westward, towards George's Island. Were not those outmost islands of solid rock, they would long since have disappeared, and have left the main channel exposed to the fury of the waves.

George's Island has been much worn away on the outer side, where it presents a bluff almost vertical, 60 or 70 feet high, above the level of low water. As this island, commanding both the main channel and Nantasket Roads, was selected for the site of an outer fortification, it became important to prevent its further injury, and to secure the portion which remained. This was done by building a sea wall just above the low water level, around the eastern and southern exposed sides. The wall is 1933 feet long, 10 feet thick at bottom, and 4 feet at top, and 13 feet 6 inches high, including the foundation. It is protected on the outside by an *enrockment* (Fr. enrochement) of large granite blocks laid irregularly, about 4 feet deep at the foot of the wall, and extending out about 20 feet from it. The back of the wall is filled in with earth, which is covered for a space of 15 feet wide, with a flagging of split granite, about 10 inches thick and laid closely, the insterstices being filled with gravel. This wall contains 6400 perches, equal to 12,800 tons of granite, besides 3000 perches of rough stone for the enrockment and breakwater, and its total cost to the general government was about $65,000. The S. W. angle of the Island has been effectually protected by a breakwater of rough stone, 6 or 8 feet high, and from 20 to 30 feet wide at base; connecting with the sea wall. Its efficiency leads to a doubt whether a similar structure would not have supplied the place of the sea wall at less expense.

Deer Island was also fast wearing away, exposed to the full fury of breakers which had rolled across the whole Atlantic Ocean. Its preservation was so important to the safety of the President Roads, that it has also been protected by a sea wall around the exposed portions, built at the expense of the United States, and which will be entirely completed during the present season. This wall, commenced

at a later period than that on George's Island, is similar to it, with such improvements as were the result of experience. Being in a more exposed situation, it is made of greater strength, as shown in the accompanying profile or section. It consists of 11 courses of split granite; of which the first three constitute the foundation, laid in a trench excavated below the level of ordinary low water. The dimensions of the courses, with the retreat of each in front, are given in the following table.

Course.	Width.	Height.	Retreat.
1	10·6″	2·0″	0·3″
2	10·0″	2·0″	0·3″
3	9·6″	2·0″	0·3″
4	8·6″	1·4″	0·6″
5	7·2″	1·4″	1·4″
6	6·0″	1·4″	1·2″
7	5 0″	2·0″	1·0″
8	4·6″	2·0″	0·6″
9	4·0″	2·0″	0·6″
10	4·0″	2·0″	0·6″
11	4·0″	2·0″	0·6″

The enrockment and backing are the same as at George's Island; their object being to protect the earth at the back and foot of the wall from degradation. The sea wall on Deer Island consists of three separate portions, of which the total length is 3134 feet. It contains 17,635 perches, equal to 35,270 tons of split granite, besides 4547 perches in the rough, for the enrockment; and its total cost, including the backing with earth &c., will be about $160,000. Both these walls have been constructed under the superintendence of Thomas B. Smith, Esq., U. S. Engineer Agent.

Castle Island, the site of Fort Independence, has also been partially protected by a sea wall of inferior execution; which it is intended to enlarge and repair.

The outer side of Long Island, near the upper Light House, continues to be worn away; and a sound policy requires that it should be better protected, for the future benefit of the harbor. P.

Boston, March 29th, 1834.

[For the Mechanic.]

STRENGTH OF CORDAGE.

The Boston Hemp Manufacturing Company have lately put up a machine, at their ropery, on the Milldam, for the purpose of determining the strength of their cordage, which is made from yarns spun by Treadwell's machinery, in comparison with cordage spun in the common method, by hand. A great number of experiments have been made by breaking ropes, of various sizes and kinds, on this machine, and the following exhibits the average result of these trials. The figures show the number of pounds required, *by each inch of the square of the girt of the rope*, to part it.*

Whale line, spun by hand, best that could be procured,	776	pounds,
Whale line spun by machines,	994	"
Russia bolt rope, 1st quality,	723	"
Bolt rope of machine spun yarns,	915	"
Running rigging, 1st quality, Russia,	442	"
Running rigging, American, spun by hand,	631	"
Running rigging of machine spun yarns,	717	"
Cotton line,	604	"
Coire rope,	215	"
Rope made of Manilla hemp,	610	"
Rope made of New Zealand flax (*Phormium Tenax*,)	722	"
Mean of all hand spun, hemp rope,	643	"
Mean of all machine spun, hemp rope,	875	"

Showing the machine spun ropes to be 36 per cent stronger than the hand spun. If, however, we reject the trials on Russia cordage, which is very weak, the superiority of the machine spun ropes is reduced to 24 per cent over all others.

In no instance whatever was the trial on machine spun ropes made on *selected specimens*, but the pieces to be tested were taken from common coils as made for use. Indeed, it happened that the machine spun ropes, except the whale lines, were made of hemp inferior in quality to that usually wrought in the machines. The modulus of cohesion, of the strongest rope in these experiments, is 30·700; or a rope, of this strength, could be let down into a pit 30·700 feet, or 5·8 miles, before it would be broken by its own weight. A rod of iron can sustain itself according to Mr. G. Rennie, only for a length of 19,700 feet.

* It is the common custom to estimate the strength of ropes in this way rather than by the area of the cross section, as is usually done with other materials. The terms are easily convertible, however, as *every inch of the square of the girt* of a cylinder, contains an area of ·07958 of a square inch.

On the 27th of March, by the politeness of Mr. Treadwell, we witnessed the operations of the machinery for preparing the hemp, and spinning the yarn; and we were also shown the method of impregnating the ropes with tar, which is done uniformly throughout their whole thickness, the tar being kept at a temperature below the boiling point. The ropes made of these yarns have the appearance of being *stained*, rather than *tarred*.

The superior strength of the ropes made from yarn spun by machinery appears to consist in this, that the fibres in the middle of the yarn are nearly of the same tension as those on the outside, whereas in the yarn spun by hand, they are much more tense in the middle; and the short fibres being the first to give way, the whole stress is thrown upon the outside ones, which, being fewer in number, consequently, cannot bear so much strain as a rope made up of fibres of equal tension.

The machine for trying the strength of ropes is so constructed as to try them fairly and accurately. The following experiments on the strength of three ropes were tried in our presence, and we have no doubt of their correctness.

No. 1. Whale line made at Nantucket, spun by hand—girt 2 inches; broke by 2440 pounds.

No. 2. Whale line made by the Boston Hemp Company, spun by machinery—girt 1 7-8 inches; broke by 3520 pounds.

No. 3. Running Rigging made by the Boston Hemp Company—girt 2 1-8 inches; broke by 3440 pounds.

As No. 2 was one seventh smaller than No. 1, we should add 502 pounds to the weight it actually bore, making 4022 pounds, for the weight it would have borne if it had been of the same size as No. 1. Consequently, it was 64 per cent stronger than No. 1. Again, No. 3 was one ninth larger than No. 1., we must, therefore, deduct from the weight that it actually bore, 382 pounds, leaving 3058 as the weight it would have borne, had it been as small as No. 1. It was, therefore, 25 per cent stronger than No. 1.—Eds. Mechanic.

[Compiled for the Mechanic.]

TELEGRAPHIC LANGUAGE.

The following account of the history and importance of Telegraphic Language, is principally an abridgement from an able lecture upon the subject, delivered before the Boston Marine Society, by John Pickering, Esq. That the subject will be interesting to our readers, we cannot doubt, especially if we consider the astonishing results which would accrue from the adoption of this method of transmitting information to the extent to which it is capable.

The Marine Telegraph in this city is under the superintendence of John R. Parker, Esq., who has, by assiduity and attention, introduced many essential improvements. The incalculable benefits that have already been the fruits of the telegraphic language in regard to commerce, the lives and property

that have been rescued, by affording relief to vessels shipwrecked or in distress, and the security which it gives to the sailor and the merchant, will entitle those, who by genius and perseverance, have assisted to improve a science so important, to the best feelings of the philanthropist, and, to that gratitude due to the benefactors of the human race. With these sentiments, we can but wish the proprietors all the success which the system so justly deserves.

The word *Telegraph* is derived from two Greek words—*teele*, at a distance, and *grapho* to write, or indicate by signs; as *telescope* is derived in the same manner from the Greek words *teele*, at a distance, and *scopeo*, to see. Another name is also used, which is likewise taken from the Greek —*Semaphore*, from *seema*, a sign, and *phero*, to bear or carry.

The Telegraphic art, properly so called, was not unknown to the nations of antiquity. It is often traced back to the siege of Troy, the fall of which city is said to have been made known in Greece by fire-signals. The Greeks certainly had invented a method of expressing, by the number and arrangement of torches, every letter of their alphabet; so that a guard on one eminence could converse with another, at a distance, by spelling his words.

In more modern times, besides fires, objects elevated in the air, smoke, sky-rockets, and discharges of cannon have been employed. But all these modes are very imperfect, as well as too expensive and troublesome.

The celebrated Marquis of Worcester contrived a species of telegraph of considerable merit. Several other individuals also devised different systems of signals. The first idea, however, of a telegraph, upon a plan similar to those now used, was suggested by Dr. Hooke, who constructed one during the siege of Vienna by the Turks in 1683; and his plan was quite as ingenious, though not so useful, as those which are now adopted in Europe.

The Telegraph used in this city is on the principle of Sir Home Popham's, and consists of an upright post (as in the annexed plate,) having a small moveable arm at the upper end, called the Indicator, and two larger arms at convenient distances below the Indicator. The Indicator (which is used by itself, as will be hereafter explained) and the arms may be placed each in six different positions as shown on the plate. These several positions denote the numerals from 1 to 6; so that the two arms together may take twice six, or twelve, positions; and this number, by

the familiar principle of permutation, affords sufficient signs to express any numeral, from one to hundreds of thousands; the *numeral system* being now used in this place.

With the Telegraph are used *three* books, like dictionaries, containing sets of numerals placed in order, with the words denoted by them standing against those numerals, exactly upon the principle of a dictionary of any language. The telegraphic dictionary only differs from any other, in having a series of numerals, instead of a series of words, under each letter of the alphabet, with the meanings of the numbers affixed to them.

Now the arms of the Telegraph, being placed in certain positions, denote particular numbers; the observer then, upon seeing the positions of the arms, looks into his telegraphic dictionary for the number denoted by them, and by the side of that number he finds the word signified by it. This is a general view of the principle of the invention. This numerical dictionary embraces, so far as can be anticipated by experience, all the questions and answers which are likely to occur between vessels at sea, or at the telegraphic stations on the coasts. It also contains a list of *numerals* designating the names of vessels, and the names of the principal countries, ports, towns, cities, rivers, capes and harbors.

The first of the three books above mentioned may be called a general telegraphic dictionary, and is familiarly known by the name of Elford's Book.* The second is an extensive Appendix to Elford's Book, by Mr. Parker; and the third is called the Boston Harbor Signal Book, which, as its name imports, is for the particular use of the port of Boston. This book, besides a considerable number of important questions and answers, contains a list of 1500 sail of vessels belonging to Boston and other ports of the United States, the name of each of which is designated by a particular numeral; which saves the trouble of spelling the name letter by letter, as must be done in the case of vessels whose names do not happen to be in that list.

You will naturally ask how the observer is to know which of the three books he is to look into in order to find the numbers given by the telegraph. This is easily explained. Each of the three books has its appropriate

* From the name of Mr. Elford, the respected author, who resided in Charleston, South Carolina, and died a few years ago.

designation. The first of the books, as I have observed, is known at the telegraph stations by the name of *Elford's Book;* and when this is to be used, it is designated by the *Indicator*, or small upper arm of the telegraph, by two positions, denoting 6—4, which may be called the numerical name of that book. A brief exemplification will make this intelligible. When the observer at one station wishes to communicate with the other, he places the Indicator in a perpendicular position; in which it is kept during the whole time of the communication, except when changed to designate one of the books, as explained hereafter. Let us suppose that an observer at one of the stations should wish to inquire of the person at another, whether he had anything to communicate. This question will be found in *Elford's Book.* Now, before asking the above question, the observer puts the Indicator, first into the position denoting number 6, and then changes it immediately to the position for number 4; which is noted down on a slate or on paper thus, 6—4; the person inquired of then knows that he is to look into that book for the matter in question, whatever it may be. The first observer then has recourse to the two *arms* of his telegraph; with which he first makes the signal denoting the numerals 4 and 3, and then immediately adds the signals for 2 and 4, thus making the entire number 4324, against which number in the book, the person at the other station finds this question: Have you anything to communicate? Being thus possessed of the question, he prepares to answer it; and as his answer, either *yes* or *no*, is to be found in Elford's Book, he also in the first place, by means of the Indicator, gives the numbers 6—4 to denote that book; and then immediately answers by the sign for number 4, which means *yes*, or by number 1, which is *no.* The whole operation may be set down as in the following table; in which the explanations are added in words, for the convenience of the reader, though in the actual operation nothing but the figures would be written down by the observer:

Question by the first Observer:

Numbers by the Indicator.	Numbers by the Arms of the Telegraph.
(Elford's Book) 6—4	4324 Have you anything to communicate?

Answer by the second Observer:

(Elford's Book) 6—4	1	No.
6—4	4	Yes.

The second book is a very copious *Appendix* to Elford's Book, by Mr. Parker; who, in order to extend its usefulness, has very judiciously added, in a distinct column, the Numerals, Phrases, &c. of the Holyhead Telegraphic Establishment in Great Britain; which is highly important to the interests of British and American commerce; there being a line of Telegraphs along the coast of England, from Holyhead to Liverpool. Mr. Parker's Book also is designated by the Indicator; not however by one fixed and invariable number, but by several different combinations of numbers, each of which at once directs the observer to a particular subdivision or letter of the dictionary, instead of the entire work; and under the letter designated by such numbers will be found the principal or important word of the sentence. For instance; suppose the Indicator should give the numbers 1—5. Now as this number does not denote Elford's Book (which is 6—4,) nor the Boston Harbor Signal Book (which is 6—5,) it follows, that the observer is to look into Parker's Appendix. In that it will accordingly be found, that the numbers 1—5 denote the subdivision or letter D, under which the principal word or subject of inquiry will be seen. After this, if the following numbers, for example, should be given by the *arms* of the Telegraph—2,—6,—4,—the observer would find against that number under the letter D, the following: '2, 6, 4, is in great Distress, and requires immediate assistance.'

The Harbor Signal Book is designated by the numerals 6—5, by the Indicator. Each of the three Books, therefore, having its appropriate name in figures, no embarrassment can ever arise as to the particular one to which the observer is to refer.

The Telegraph, at the Observatory on Central Wharf communicates with three stations in our lower harbor; one upon Long Island, under the charge of Mr. Charles Beck; another, at Point Alderton, Nantasket Heights, under Mr. Joseph Pope; and the third at Rainsford Island, (the Quarantine establishment) under Mr. John Minot. The distance of this whole line is about twelve miles—and intelligence may be conveyed through the line in about two minutes.

Thus far I have given you an account of telegraphic operations *by land*, where we can erect elevated objects, and have a distinct view of the arms or signal boards of a telegraph. But it is obvious this method would be impracticable at sea.

To supply this deficiency, an essential improvement has of late years been introduced, by means of flags, and called the *Marine Telegraph.* The use of flags rests upon the same principle with the arms of the land telegraph. They are six in number, and correspond to the six positions of the arms of the land telegraph; denoting the numerals 1, 2, 3, 4, 5, 6,—they are each *blue* and *white*, and all of the same size; with duplicate numbers of each flag. To these is added a *Conversation Flag*, which, like the *Indicator* of the land telegraph, shows that the ship making the signal wishes to converse. Nearly ten thousand changes or combinations can be made, designating the words and phrases in the books above-mentioned. By these means ships at sea can communicate with each other even at the distance of several miles; and when they approach the coast, can hold communication with the Land Telegraph.

From this illustration of the uses of the Telegraph by land and by sea, you will be able to form some judgment of its vast importance to a great commercial country, possessed of such an extensive sea-coast as ours, and having a constant intercourse with all parts of the globe. I say nothing of its incalculable value in case of war, when a rapid communication of intelligence may be of vital importance to the whole population of a town, a city, or even of the country at large; but, in ordinary times of peace, and in the usual course of commercial business, when we consider its utility, in the preservation of property, and above all, the lives of our seafaring brethren, we cannot sufficiently appreciate the great value of this invention. I cannot forbear alluding once more to a case which actually happened not long since in this port,—the case of the *Boston*, which most of you will recollect. When that vessel was relieved by means of a telegraphic communication, the wind was blowing so strong off shore, that it would have taken her boat several hours to have come up to the city for assistance; it would have been night time, too, when she reached the wharf; then there would have been the delay and trouble of getting ready the necessary articles to be sent down to her, which would have required in the whole several hours; and, perhaps, by the time assistance had reached the spot, the vessel with her exhausted crew would have been swallowed up in the depths of the ocean. But, by means of the telegraph, which despatches its intelligence without regarding either

winds or waves, requisite information reached our city in ten minutes; and, in the short space of *fifty-five* minutes from its arrival, a boat was fitted out with every necessary for the occasion, and in about two hours was actually on the spot, affording the desired relief to our perishing brethren.

Thus far we have directed our attention to the utility of *telegraphic* communication with respect to the practical concerns of our commerce; and this, undoubtedly, is of the highest importance, because it immediately concerns the preservation of human lives.

But the application of the art to other subjects will naturally follow the progress of those rapid improvements which are believed to be characteristics of the present age. If, for instance, we take the case of *commercial affairs* in general, we know what a change has taken place in the transmission of intelligence relating to business within a few years past; and it would seem too, as if every new impulse in business rendered it necessary to add new energy to our means of communication.

Is it too much to suppose, that the demands of business may before a long time lead to the establishment of telegraphic communications between our principal cities? Twelve years ago it was stated in the French papers, that *three thousand* messages could be conveyed in one day from Paris to any extremity of France, and that answers could be received to them. Even since I have been preparing to meet you at this time, the question has been agitated as to the practicability of a telegraphic line, for purposes of business, between the great seat of our northern manufactures and this city. And why may we not look forward to the time, when there shall be such a communication between this city and New York, Philadelphia and Washington? I dare not presume to predict such an event for some time to come; and yet, when we daily witness the extraordinary resources of this growing country,—when we observe the wonderful results of an intelligent and active population, incessantly occupied in developing their powers and resources—and stimulated by the circumstances in which they are placed, to greater and more intense exertion than the same number of people have probably ever been, —when we see too, that all ordinary calculations, founded upon the precedents of other nations, fall short of what is here actually accomplished,—when we witness all this

we cannot believe that it is being too sanguine, to expect the application of the telegraph to a vastly greater extent than we have yet seen.

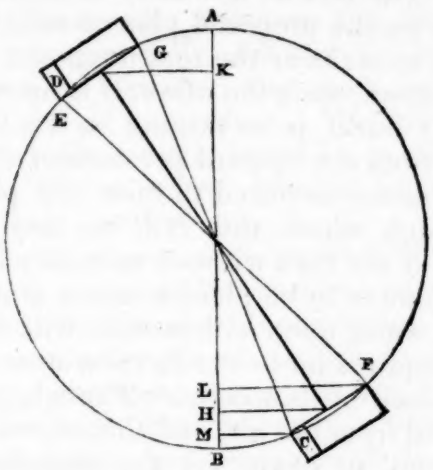
How is it, that even the rapidity of the public mail is not sufficient to satisfy the demands of a business community; and we therefore see the editors of our newspapers, at an enormous expense, establishing private expresses to convey intelligence from the seat of Government to our principal cities? It is because the measures of the Government are of vital consequence to the business, as well as to the political rights, of the citizens. When, therefore, we find by actual experience, that this rapid mode of communication is deemed necessary to the wants of an active community, who will venture to set bounds to its application? We can, in imagination, suppose it to be extended on our coast, from one end of the continent to the other; and if any people shall ever carry it from our Atlantic shores across the continent to the coast of the Pacific ocean, I feel the strongest conviction, that it will be accomplished by our countrymen; when we may obtain intelligence from China in as short a time as it now reaches us from Europe!

Having given the substance of Mr. Pickering's lecture on telegraphic language, we have annexed a *fac simile* of Mr. J. R. Parker's Semaphoric Telegraph, as well as the Marine Telegraph Flags, at the beginning of the present number, wherein is exhibited a practical exemplification of a telegraph communication, as contained in the United States Telegraph Vocabulary; a second edition of which, we understand, Mr. Parker is preparing for the press; comprising twenty thousand words, phrases and sentences, applicable to telegraphic purposes, and upon every subject, together with the designating numbers of nearly fifteen hundred American vessels, which have adopted this system of telegraphic communication.

We understand that the Navy Department of the United States have lately been furnished with sets of the Marine Telegraph Flags, and a designating number and a signal book for each vessel, which will enable the Government vessels and Revenue Cutters to hold communication with our merchantmen in every section of the Union, as well as to communicate with the several telegraph stations upon our coast.

[For the Mechanic.]

UNITING AIR AND WATER WHEEL.



Messrs. Editors:—I cannot perceive that either of your correspondents, who have made themselves merry at the expense of the projector of the 'Uniting Air and Water Wheel,' have exposed the fallacy of his project. Both have decided that it will not go; but neither have explained why it will not go. They have left the ground upon which they would have met W. W. C., to tilt at men of straw of their own setting up. Thus 'Junius' has introduced a wheel, in which its inventor supposed 'the weights would act with greater power on one side than the other.' W. W. C. makes no such claim for his machine, but thinks that the upward tendency of the air will cause it to revolve. But 'Junius' and 'K' both tell him that he left out all idea of pressure, when he supposed the weight of the water would cause the air to pass from cylinder E into cylinder A. He never supposed it would, but he did think the weight of the leaden pistons would produce that effect; and I, for one, can find nothing in the present laws of nature to prevent it. But there is one circumstance which 'Junius,' 'K,' and 'W. W. C.' seem all to have overlooked; which is, that if the wheel be in motion, the *weights* will act with greater power on one side of it than on the other; and this will be the ascending side, whichever way it is turned; for the leaden pistons are continually slipping towards the bot-

tom of the wheel, those on the ascending side being carried twice through the same space, and those on the other, falling through a certain space without assisting the descent by their weight. There is no absurdity in supposing a wheel could be made on the proposed plan, in which the cylinders would fill with water near the top, upon one side, and with air near the bottom, upon the other, if it be turned by some external force; but if, in so turning it, we find the assistance received from the upward pressure of the air to be no more than the power required to raise the pistons through the space through which they fall, we may conclude that the wheel would not turn without an external force.

As the machine is to be placed under water, filling the cylinders with water upon either side will have no effect upon it. It requires no power to raise water in water, nor will any be gained by its weight. The whole power of the wheel is derived from the air, and this, as we shall see, will not be sufficient to overcome the impediments already mentioned.

Through the wheel draw the vertical line AB. The pistons on the left side of AB can act by their gravity only, till they reach the point B; on the right, they will resist till they come to A. The piston D in falling from E to B, is capable of raising an equal weight from F to A; but the piston C, which it is intended to raise to that point, is the length of one cylinder behind F; and if we suppose the pistons to have just fallen, C has been raised from B to F, while D has acted by its gravity only from A to G. We see, then, that connected with the revolution of each pair of cylinders is a loss of the power requisite to raise a piston twice the length of a cylinder. What must be the weight of the piston? Half that of a column of water, whose base is its area, and whose height, the perpendicular distance between the two opposite pistons at the time they fall; for D assists C in its descent by the medium of the air between them, so that each sustains half the weight of the column of water above C, after deducting the column above D. Using the letters a for the area of the piston, d for the distance between the pistons, and l for the length of the cylinder, we have for resistance

$$\frac{a \times d}{2} \times 2\,l = a \times d \times l.$$

The upward pressure of the air, (supposing its specific gravity nothing,) is as the weight of an equal bulk of water, which, multiplied by the space through which this pressure is exerted, gives the power received from it. This space is the perpendicular between the two cylinders at the time their pistons fall; for the air in C assists the motion from H to A, but from this must be deducted KA, through which the air in D resists. The body of water displaced from the cylinder C is found by multiplying its area by its length. The assistance then is no more than the resistance, for it is $a \times l \times d$.

But if C falls in the present position of its cylinder, it will only have to be raised the perpendicular distance LM, which is less than the length of the cylinder. True; but just in proportion as the length of the fall is diminished, the weight of the piston must be increased, for the weight, resting on an inclined plane, to resist a pressure, must be as much greater than the perpendicularly falling weight capable of resisting the same pressure, as the length of the plane is greater than its height. This is the most favorable light in which this machine can be viewed, for I have not taken into consideration the thickness of the pistons in estimating the length of the column of water between them, and I have supposed the air to transmit perfectly the motion of one piston to its opposite. There are also faults which I have not mentioned, because they might be remedied. C.

We have received an article from W. W. C., in defence of his 'New Water Wheel,' against our correspondents in the last 'Mechanic;' but, on the receipt of the above, we concluded to defer the publication of it in the present number, under the impression, that our present correspondent's ideas upon the subject would have some influence on the opinion of the inventor. If, however, he should request it, we will publish it in the forthcoming number.—Eds. Mec.

[For the Mechanic.]

MY NOTE BOOK.—NO. III.

The following curious recipe propagated by the alchemists of olden time, is thus given by Bishop Wilkins, in his work on 'Mathematical Magic,' a copy of which, dated 1648, is now before us. It is certainly the most concise

and clear recipe we have ever seen, for gaining the *object*, and in our opinion, there is no doubt that success would attend the labors of any one who should proceed according to *these* directions. There may be some difficulty in procuring the *materials*, especially, those represented by the symbolical characters; as we apprehend they will be more easily found in the vocabulary of an astronomer than in that of a modern chemist. Our apprehensions, however, in this particular, may possibly be groundless; for, if our memory is not very treacherous, we believe we have seen, amid the variety of compounds placed in the window of an apothecary, in Washington Street, two large bottles glowing with green and red, which bore similar characters to those in the recipe. If they should not contain what their labels represent, we would suggest the propriety of arraigning the owners before the court of good sense, to show cause, if any they have, why their bottles should be thus labelled with the mysterious characters of the ancient alchemists and astrologers, when they cannot furnish the *compounds* of the one, nor fathom the secrets of the other. The recipe, we shall give, 'word for word' and 'letter for letter,' as near as our modern types will permit, that no unsuccessful experimentalist may attribute his failure to any inattention on our part.

Perpetuall Motion.—Mixe five ounces of ☿ with an equall weight of ☽, grinde them together with ten ounces of sublimate, dissolve them in a Cellar upon some marble for the space of four days, till they become like oyl olive; distill this with fire of chaffe or driving fire, and it will sublime into a dry substance; and so by repeating of these dissolvings and distillings, there will bee at length produced divers small atomes, which being put into a glasse well luted, and kept dry, will have a perpetuall motion.

Important Test for Copper in Cookery.—If soup, syrup, vinegar, or any liquid has been left by accident in copper vessels, so that you apprehend verdigrise has been formed, by the liquid and copper uniting, it can readily be detected by mixing a little of the suspected liquid with spirits of hartshorn; when, if any copper be present, it will speedily acquire a blue color, and may be considered poisoned.

SIMPLE TEST FOR OXALIC ACID.—Oxalic acid very much resembles epsom salts, and has, in a number of instances, proved fatal to persons to whom it has been administered by mistake. A simple method of detecting oxalic acid is, to dip a pen in common black ink, and apply the point to the substance. If it be oxalic acid, the ink turns *red*; if it is epsom salts, the ink remains black. From the simplicity of the test, and the frequent recurrence of the mistake, we should hope no one would neglect, hereafter, to try the ink before using. JUNIUS.

Boston, April 8th, 1834.

[From the Journal of the Franklin Institute.]

PATENTS.

PATENT *for a mode of Propelling Saw Mill Carriages;* Joseph Michenor, Chester, Clinton county, Ohio, September 16.

We cannot make our description more brief than the specification, which consists of only four lines of reference to a drawing. The carriage is to rest on friction rollers. A rope, or chain, passing twice round the rag wheel shaft, and attached to the carriage, serves to move it, instead of a wheel and cogs.

PATENT *for an Apparatus for Blowing Glass, denominated an Artificial Glass Blower;* Joseph Stouvenel, and Francis A. Martin, Philadelphia, September 16.

A metal tube is to be made which may be sixteen inches long, and one and a half in its interior diameter. This is to be open at one end, and closed at the other; a spiral spring is to fit within it, the coils of which may be half an inch apart, when extended, in which case it occupies the whole length of the tube. A piece of wood, covered with leather, is to form a piston, which may be inserted in the open end of the tube, and fits it air tight, whilst it will slide freely in it. This piston has a hole through it, to receive the mouth end of a blow pipe, which it must surround accurately. By pressing upon the metal tube, when

the blow-pipe is so placed, the air within it will be forced through the pipe, with a power, it is said, four or five times as great as can be exercised by the lungs. Articles in open moulds may be blown by the machine at one operation, which could not be accomplished by the mouth in the old way.

PATENT *for a Machine for Dressing Staves;* Lemuel Reed, of Madison county, and Alfred Willoughby, Rochester, Monroe county, New York, September 16.

This machine is less perfectly described than it merits to be; as it may undoubtedly be made to dress a stave on both sides in a very perfect manner. Its general structure, however, may be very well understood from the drawing; and we believe it is so far new that it may be defended, although there is no claim.

A wheel turning on an axis, is furnished with knives on its periphery, which are to dress the inside of the stave; a wheel, or hoop, is concentric with, and surrounds the former, at such a distance from it as is required for the thickness of a stave, and the knives by which it is to be dressed. This hoop is furnished with knives, or cutters, on its inside, and its outside is supported by three friction rollers, running in grooves made on its periphery for that purpose. A strap around the periphery of this hoop, and round a drum on the shaft of the interior wheel, will cause them to revolve, and the stave is to be passed between them by a proper feeding apparatus. It is said that by water, or horse power, one such machine will dress from twelve to fifteen hundred staves in a day.

There are no details given respecting the cutters, or the feeding apparatus, which is a manifest defect, as it is the duty of every patentee so to describe the thing patented, that a competent workman may be able to make it without the exercise of inventive genius.

MISCELLANY.

It gives us pleasure to be able to recommend Mr. Robert H. Eddy, Civil Engineer of this city, to the patronage of our readers, as well as to the public generally. He is a good draftsman in machinery, as well as in the other departments of drawing. We think he may be consulted with advantage on the subject of drawings and specifications of new inventions intended to be patented, as he has paid particular attention to the subject, and has had several years' experience in drawing up these instruments. It is a profession that was much wanted in this city. Our readers are referred to his advertisement on the cover.

Glass Works.—Just above Kensington, near Philadelphia, are the *Dyottville Glass Works*—one of the greatest curiosities of this country.

There are *four* large factories, or furnaces, each having *ten* melting pots, and constantly employing more than 300 men and boys. They make 10,000 pounds of glass a day. If they work 310 days in a year, they must make 31,000,000 pounds in a whole year. How many half-pint tumblers would all this glass make, each weighing four ounces?

In making this glass, they consume in a year, 240,000 lbs. of *red lead*, 370,000 lbs. *pot and pearl ashes*, 1,360,000 lbs. of *sand*, 2,300 bushels of *lime*, and 1,550 of *salt*. (What then is glass made of?)

Part of the fuel which they burn is *rosin*—at the rate of 50 barrels a day, or more than 15,000 a year. Besides this, they burn 1,800 cords of pine and oak wood, and 1,200 bushels of Virginia coal. Surely this is a most splendid establishment.

Of the 300 laborers, 225 are boys, some of whom are not more than eight years of age. They are industrious, orderly and apparently happy. They are taught every evening the branches of a plain, practical education. They have also a library. Almost all learn to sing, and you may hear the various companies of laborers singing most delightfully, while busy at their work, sometimes twenty or thirty times a day.

Not a drop of spirit, or any other intoxicating liquor is allowed in the whole establishment.

How to make Money Plenty.—Every person is complaining of the scarcity of money. There are many borrowers and but few lenders, and we think that the advice of that great sage and philanthropist, Franklin, could never be published at a more appropriate time than the present. Read it—reflect upon it—and follow it—ye who are complaining of hard times.

'At this time,' says Dr. Franklin,' 'when the general complaint is, that 'money is scarce,' it will be an act of kindness to inform the moneyless how they may reinforce their pockets. I will acquaint them with the secret of money catching—the certain way to fill empty purses—and how to keep them always full. Two simple rules well observed, will do the business.

1. Let honesty and industry be thy constant companions; and, 2. Spend one penny less than thy clear gain.

Then shall thy hide-bound pockets soon begin to thrive, and will never again cry with the empty belly-ache, neither will creditors insult thee, nor want oppress, nor hunger bite, nor nakedness freeze, nor bankruptcy seize thee. The whole hemisphere will shine brighter, and pleasure spring up in every corner of thy heart. Now, therefore, embrace these rules and be happy. Banish the bleak winds of sorrow from thy mind, and live independent; then thou shalt be a man, and not hide thy face at the rich, nor suffer the pain of feeling little when the sons of fortune walk at thy right hand; for independency, whether with little or much, is good fortune, and placeth thee even with the proudest of the golden fleece. Oh, then, be wise! and let industry walk with thee in the morning, and attend thee until thou reachest the evening hour for rest. Let honesty be as the breath of thy soul; and never forget to have a penny when all thy expenses are enumerated and paid; then shalt thou reach the point of happiness, and independence shall be thy shield and buckler, thy helmet and crown; then shall thy soul walk upright, nor stoop to the silken wretch because he hath riches, nor pocket an abuse because the hand which offers it wears a ring set with diamonds.'

Remarkable Falls.—There is a fall in a small stream in Southern Hindostan, 892 feet high. Think, reader, of a stream falling that distance! Why, it is the height of five or six tall steeples, placed one above the other. There is a fall north of Lake Superior, and another in Lower Canada, and another still, near Bogota, in South America, which are *almost* as high. That of Niagara is little more than 150 feet.

The Great Pyramid of Egypt cost the labor of one hundred thousand men for twenty years, exclusive of those who prepared and collected the materials. The steam engines of England, worked by thirty six thousand men, would raise the same quantity of materials to the same height in 18 hours.

THE PHILOSOPHER OUTDONE.—A learned philosopher being very busy in his study, a little girl came to ask him for some fire. 'But,' says the Doctor, 'you have nothing to take it in;' and as he was going to fetch something for that purpose, the little girl stooped down at the fire-place, and taking some cold ashes in one hand, she put live embers on them with the other.

The astonished doctor threw down his books, saying, 'With all my learning I should never have found out that expedient.'

A TRIAL of Engine Hose took place in this city a short time since, which resulted, in the most decided manner, in favor of a new article manufactured by the Roxbury India Rubber Factory, composed of canvass with a covering of India Rubber.

TRANSPARENCY OF THE SEA.—There is nothing, perhaps, that strikes a northern traveller more than the singular transparency of the water; and the farther he penetrates into the Arctic regions, the more forcibly is his attention rivetted to this fact. At a depth of 20 fathoms, or 120 feet, the whole surface of the ground is exposed to view. Beds composed entirely of shells, sands lightly sprinkled with them, and submarine forests, present through the clear medium new wonders to the unaccustomed eye.

CAPERS.—The pickle in common use, under the name of capers, is made of the young flower buds of a beautiful shrub found in the Levant and the South of Europe, where it grows wild among rocks and rubbish, and is as common as the bramble is with us.

MR. SMITH, of Va., says, castor oil and spirits of turpentine, combined in proportion of one to four, produces an excellent composition for lighting rooms. It is equal to sperm oil.

TO CORRESPONDENTS.

SEVERAL articles are necessarily delayed until our next. We request those who possess information on the subject, to give us their views in regard to rendering buildings more secure from fire, the best means of preventing the communication from one house to another, and from one room to another in the same house.

QUESTIONS.

A CONE, the diameter of whose base is 10 feet, and whose altitude is 12 feet, is cut obliquely by a plane which enters 3 feet from the apex on one side, and comes out at 3 feet from the base on the opposite side. Required the dimensions of the section.

A VESSEL in the form of the lower frustrum of a cone, containing 13 gallons of wine, is 12 inches high; and the diameters of the upper and lower bases are in proportion to one another, as 3 is to 5. What are the two diameters?

ANSWERS.

Fig. 1.

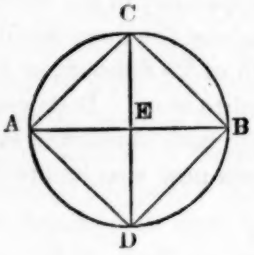


Fig. 2.

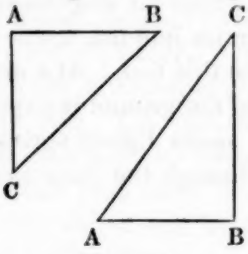
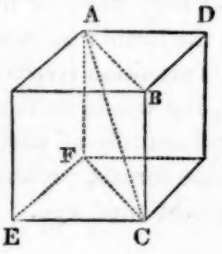


Fig. 3.

Fig. 4.



MESSRS. EDITORS:—In answer to the two questions, in the January number of the Mechanic, respecting the circle and the globe, I would say that the side of the greatest square is $= \sqrt{50}$; and the side of the greatest cube is $= \sqrt{33{\cdot}333333}$.

The solution of the first is as follows:—The diameter of the circle AB, fig. 1, being 10 inches, the radius EB or CE is 5 inches; the two radii EB and CE make the base and perpendicular of the right angled triangle CEB; hence, by the Pythagorean proposition, the square described upon the hypothenuse CB, is = to the sum of the squares described upon the other two sides CE and EB; hence we have this equation $\overline{CE}^2 + \overline{EB}^2 = \overline{CB}^2$, or (making CB, the required side, $= x$,) $x^2 = 5^2 + 5^2$, or $x^2 = 25 + 25$, whence $x^2 = 50$; and, extracting the root of both sides of the equation, we have $x = \sqrt{50} = 7{\cdot}071$ inches, for the side CB of the greatest inscribed square.

As it respects the second question, we suppose $x =$ to the side of the proposed cube AB, fig. 2; then x will also be equal to the side AC, (being equal sides,) hence $\overline{AB}^2 + \overline{AC}^2 = \overline{CB}^2$; that is to say, the sum of the squares described upon the two sides of the cube, is equal to the square of the diagonal of one of the faces, that is, of CB; hence $x^2 + x^2$, or

$2x^2 = \overline{CB}^2$; extracting the root of both sides of this equation we have $\sqrt{\overline{2x}^2} = CB$; hence, it is perceived, that we have the right angled triangle ABC, fig 3, of which the side AB, or the side of the cube, is the base; the side BC, or the diagonal of one of the faces of the cube, the perpendicular; and AC, or the diameter of the globe, the hypothenuse; hence we come again upon the Pythagorean proposition. Now we have supposed the base equal to x; we have also found by a former equation that the perpendicular BC is = to $\sqrt{\overline{2x}^2}$; then we have $x =$ the base; $\sqrt{\overline{2x}^2}$ = the perpendicular, and 10 = the hypothenuse; and by taking the sums of the squares of both sides, we have $2x^2 + x^2 = 100$, or $3x^2 = 100$, and $x^2 = 33{\cdot}333333$: consequently $x = \sqrt{33{\cdot}333333}$. E. G.

N. B. The solution of this last question may easily be conceived by the examination of a cubic block, and by supposing the diagonal of the *cube* equal to the diameter of the globe.

Solution of two questions proposed in the Mechanic for January.

1. The greatest square which we can inscribe in a circle, is that whose diagonal is the diameter of the circle.

The side of the square, is equal to the square root of half the square of the diagonal.

In this case, the diagonal AB, fig. 1, is 10 inches; and the side AC of the required square, 7·071.

2. The greatest cube contained in any globe, is that in which the diameter forms the diagonal of a rectangular parallelogram, ABCF, fig. 4, which divides the cube into two right angled triangular prisms.

One side, BC, of this rectangle, is a side of the cube; and the other side, AB, the diagonal of a face of the cube.

Let D = the diagonal AC of the rectangle, d = the diagonal of a face of the cube; and x = the side of the cube.

$$\begin{aligned} \text{Then} \quad & 2x^2 = d^2 \\ \text{And} \quad & d^2 + x^2 = D^2 \\ \text{whence} \quad & 3x^2 = D^2 \\ & x^2 = \frac{D^2}{3} \\ & x = \sqrt{\frac{D^2}{3}} \end{aligned}$$

Now by the question, D = 10 inches, hence the formula $x = \sqrt{\frac{D^2}{3}}$ becomes $x = 5{\cdot}773$. EUCLID MINOR.

MESSRS. EDITORS:—In your January number there are two questions; one requiring the side of the greatest square that can be inscribed in a circle 10 inches diameter; and the other, the side of the greatest cube contained in a globe 10 inches diameter.

1. If the diameter of any circle be multiplied by ·7071, the product will be the side of the inscribed square. In the present case the answer is 7·071 inches.

2. If the diameter of any globe be multiplied by ·57735, the product will be the side of the greatest cube contained in the globe. The answer in this case is 5·7735 inches.

To use a familiar demonstration, in the case of the globe and cube, let us suppose the cube to be formed by cutting off six pieces from the globe, leaving the corners of the cube exactly in the surface of the globe; it is clear, that a line passing through the cube, cornerwise, will be of the same length as the diameter of the globe. Having found a line that is common to both the globe and cube, and knowing the length of this line, which is given, 10 inches, we may find the length of the side of the cube, by the aid of the forty-seventh problem of Euclid.

In any room in the form of a cube, drop a line from one corner of the ceiling to the floor, extend the line across the floor to the opposite corner, and from thence to the corner of the ceiling from whence we started. By the problem alluded to, we find that the square of the line which crosses the floor cornerwise, is equal to the squares of two sides of the floor; but we find, also, that the square of the line crossing the centre of the room, from the ceiling to the floor, diagonally, is equal to the square of the line crossing the floor, added to the square of the perpendicular; and consequently, to the squares of three sides of the room added together. Then we say, that the side of the cube is equal to the square root of one third of the square of the diameter of the globe. Now, the diameter of the globe is 10, and the square of the diameter 100, one third of which is 33·333, &c., and the square root 5·7735, which is the side of the cube. PHILO.